Brines of RIS countries as a source of critical raw materials and energy supply
- SUMMARY OF THE ACTIVITIES-

EIT RM KAVA 8 RIS
Capacity Building Project
(2022-2024)

Supported by EIT RawMaterials Connecting matters
Co-funded by the European Union

THANK YOU!

The Team

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Brines of RIS countries as a source of critical raw materials and energy supply
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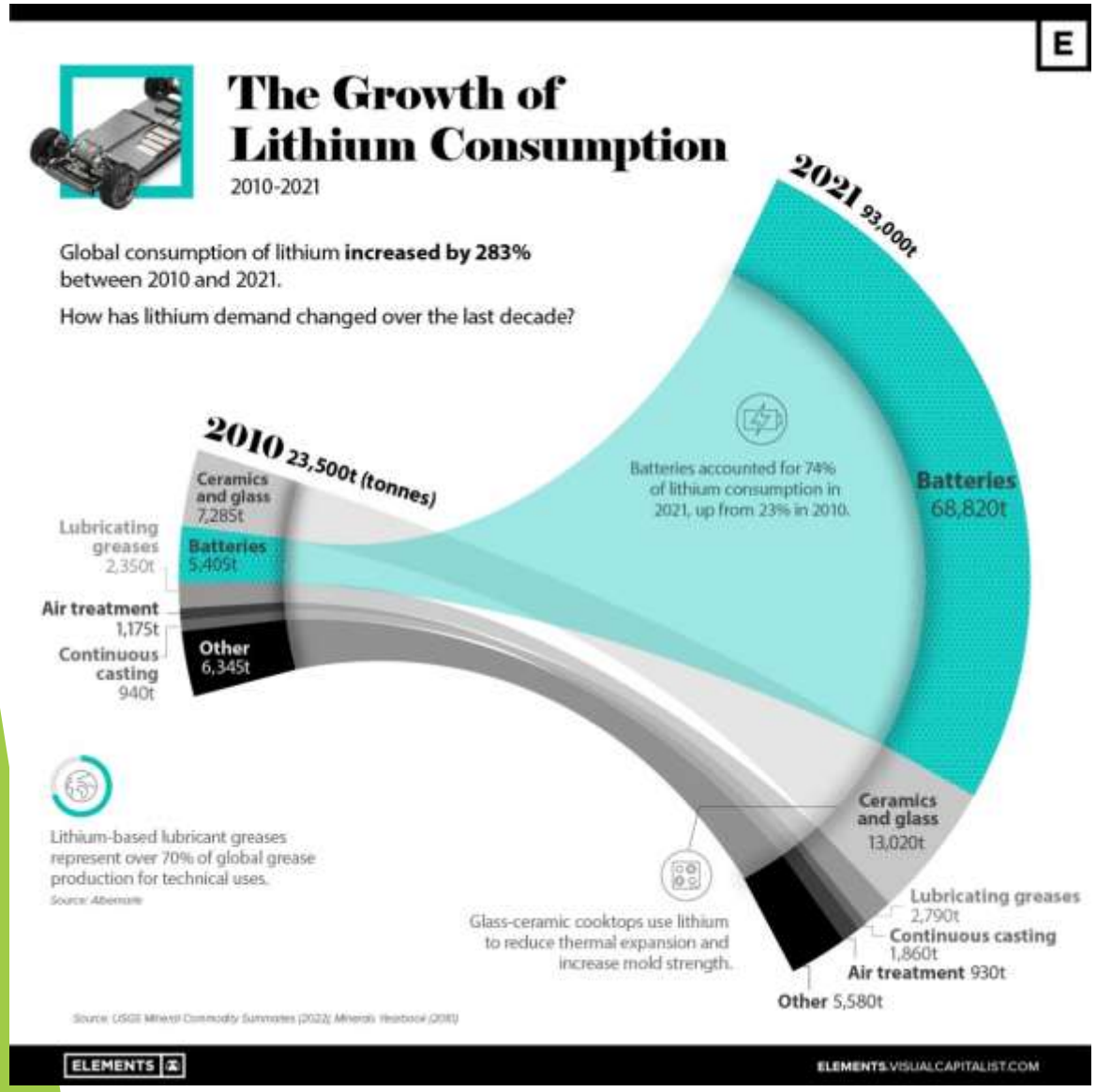
PARTNERS

- **Politechnika Wrocławska (Wroclaw University of Science and Technology, WUST) [Poland, CLC East Core Partner] - LEADER**
- Agencia Estatal Consejo Superior de Investigaciones Cientificas M.P., CSIC (Spanish National Research Council) [Spain, CLC South Core Partner]
- European Lithium Institute eLi [Belgium/Germany, CLC Central, Associated Third Party]
- Geologian tutkimuskeskus, GTK (Geological Survey of Finland) [Finland, CLC Baltic Core Partner]
- Ghent University [Belgium, CLC West Core Partner]
- Redstone Exploration Services Sp. z o.o. [Poland, CLC East Project Partner]
- **Technische Universität Bergakademie Freiberg (TUBAF) [Germany, CLC East Core Partner]**
- University of Miskolc [Hungary, CLC East Core Partner]

TASK PARTNERS:

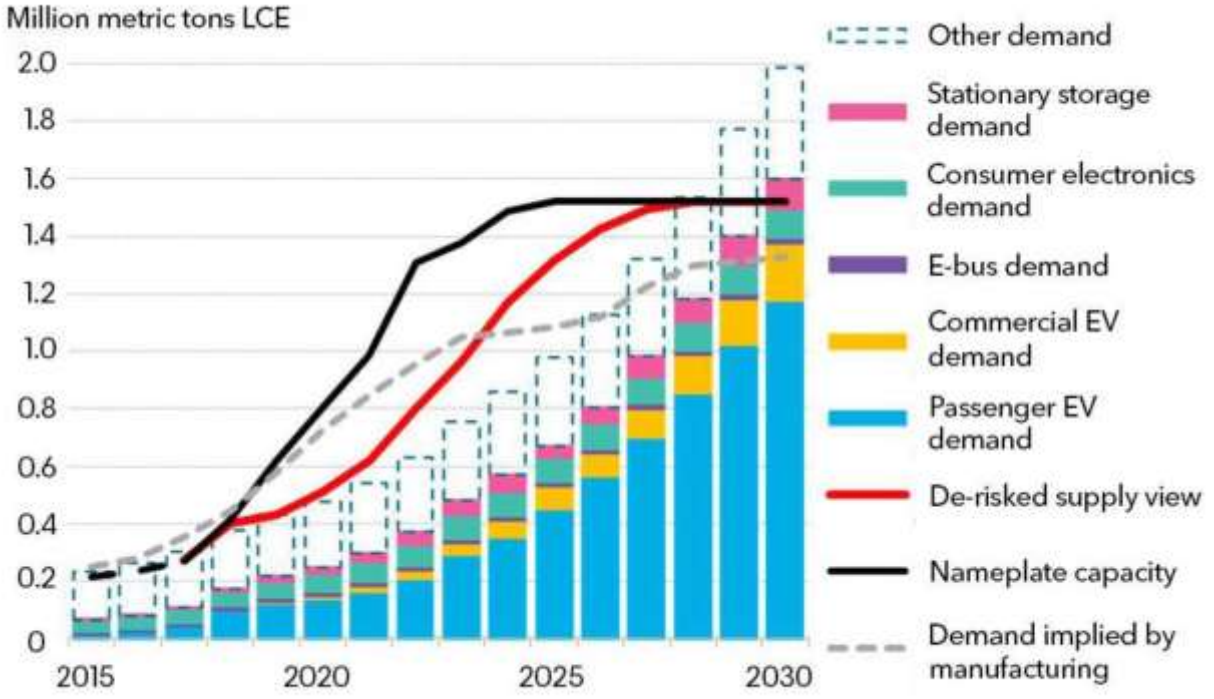
- Polish Geological Institute – National Research Institute, Poland
- Czech Geological Survey, Czech Republic
- State Geological Institute of Dionyz Stur, Slovakia
- Rotaqua, Hungary

BACKGROUND



Published in September 2020 list of critical raw materials of EU contains 30 materials among which lithium, titanium, and strontium are added to the list for the first time. The list includes the materials that are of high economic importance and present the highest supply risk for the EU. Updated in 2023 up to 34 critical materials – arsenic for the first time.

Rapidly growing Li demand forecast



Source: BloombergNEF, Avicenne.

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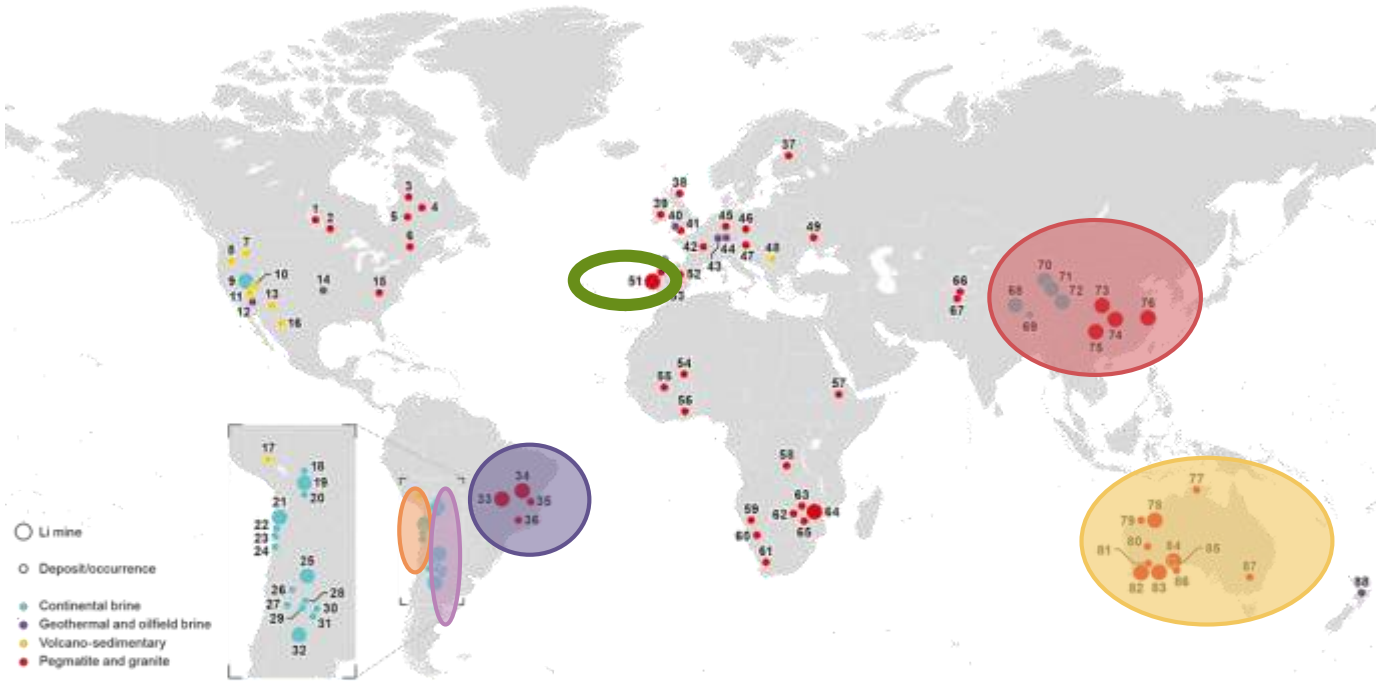
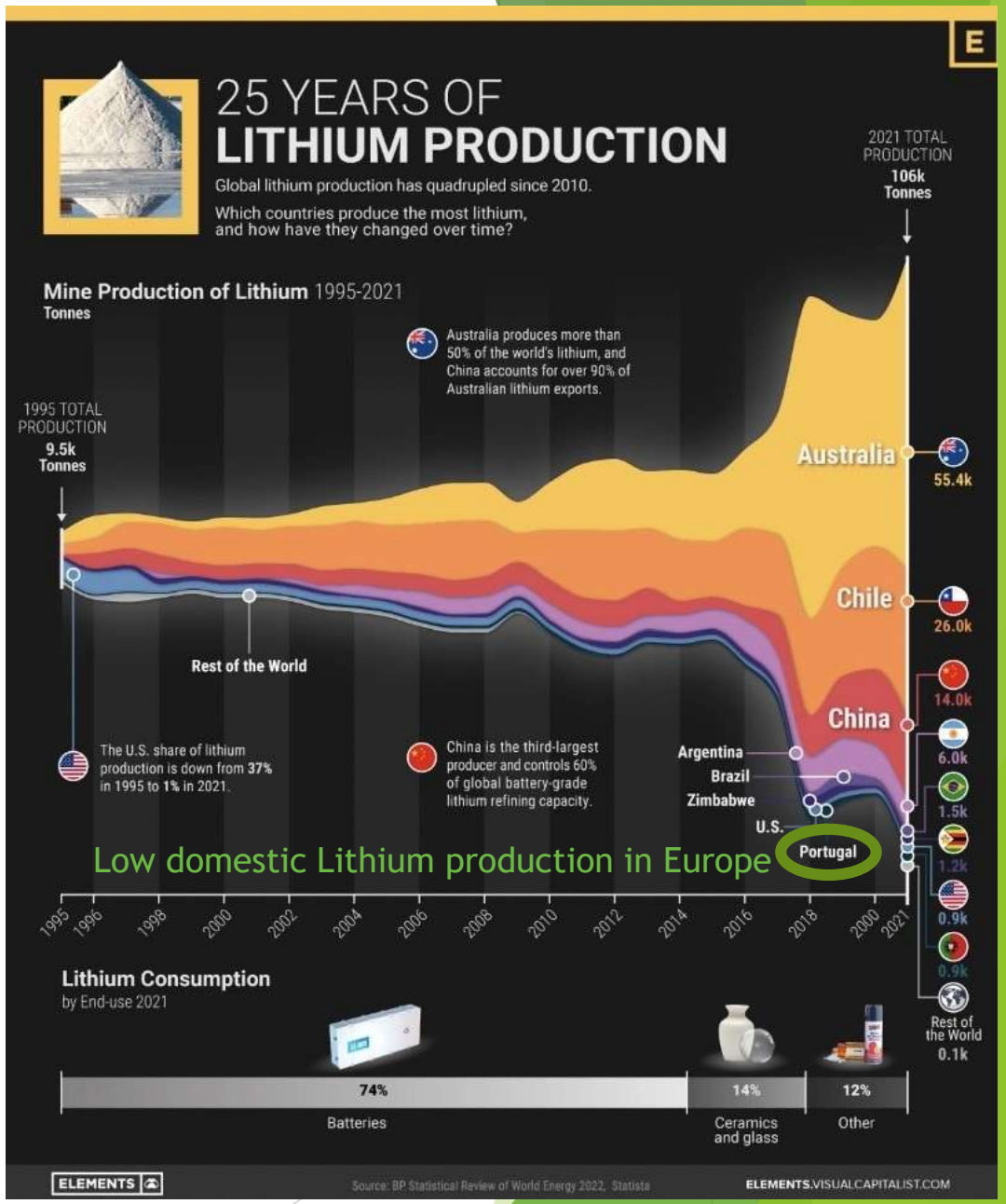
Global lithium (Li) mines, deposits and occurrences (November 2021)

British Geological Survey



1 Tanco, Canada
2 Separation Rapids, Canada
3 James Bay, Canada
4 Rose, Canada
5 Whabouchi, Canada
6 Val-d'Or, Canada
7 McDermitt, USA
8 Kings Valley, USA
9 Silver Peak, USA
10 Bonnie Claire, USA
11 Boron, USA
12 Salton Sea, USA
13 Clayton North, USA
14 Magnolia, USA
15 Kings Mountain, USA
16 Sonora, Mexico
17 Falchani, Peru
18 Salar de Coipasa, Bolivia
19 Salar de Uyuni, Bolivia
20 Salar de Pastos Grandes, Bolivia
21 Salar de Atacama (2 operators), Chile
22 Salar de Aguilera, Chile
23 Salar de Pedernales, Chile
24 Salar de Maricunga, Chile
25 Salar de Olaroz, Argentina
26 Salar de Cauchari (2 projects), Argentina
27 Salar del Rincón (3 projects), Argentina
28 Salar de Pozuelos, Argentina
29 Salar de Pastos Grandes, Argentina
30 Salar de Ratones, Argentina
31 Salar de Diablillos, Argentina
32 Salar del Hombre Muerto (3 projects), Argentina
33 Mibra, Brazil
34 Mina da Cachoeira, Brazil
35 Jequitinhonha, Brazil
36 Volta Grande, Brazil
37 Länttä (and 5 others), Finland
38 Glenbuchat, United Kingdom
39 Aclare, Ireland
40 United Downs, United Kingdom
41 St Austell, United Kingdom
42 Chédeville (and 4 others), France
43 Rittershoffen, France
44 Upper Rhine Valley, Germany
45 Zinnwald (and 4 others), Germany
46 Cínovec, Czech Republic
47 Wolfsberg, Austria
48 Jadar, Serbia
49 Polokhovskoe (and 2 others), Ukraine
50 Mina do Barroso (and 3 others), Portugal
51 Alijó, Portugal
52 Valdeflórez/San José, Spain
53 Alberta I, Spain
54 Bougouni, Mali
55 Goulamina, Mali
56 Ewoyaa, Ghana
57 Kenticha, Ethiopia
58 Manono-Kitotolo, Democratic Republic of Congo
59 Uis, Namibia
60 Karibib, Namibia
61 Orange River Area, South Africa
62 Kamativi, Zimbabwe
63 Zulu, Zimbabwe
64 Bikita, Zimbabwe
65 Arcadia, Zimbabwe
66 Parun area, Afghanistan
67 Nuristan area, Afghanistan
68 Zhabuye Salt Lake, China
69 Dangxiongcuo, China
70 West Taiji Nai'er, China
71 East Taiji Nai'er, China
72 Qinghai Salt Lake, China
73 Sichuan Aba, China
74 Maerkang, China
75 Jiajika, China
76 Ningdu, China
77 Finniss, Australia
78 Pilgangoora, Australia
79 Wodgina, Australia
80 Kathleen Valley, Australia
81 Mount Holland, Australia
82 Greenbushes, Australia
83 Mount Cattlin, Australia
84 Mount Marion, Australia
85 Bald Hill, Australia
86 Buldania, Australia
87 Narraburra, Australia
88 Ohaaki, New Zealand

How to cite: Shaw, R.A. (2021) Global lithium (Li) mines, deposits and occurrences (November 2021). British Geological Survey.



Credit: visualcapitalist.com

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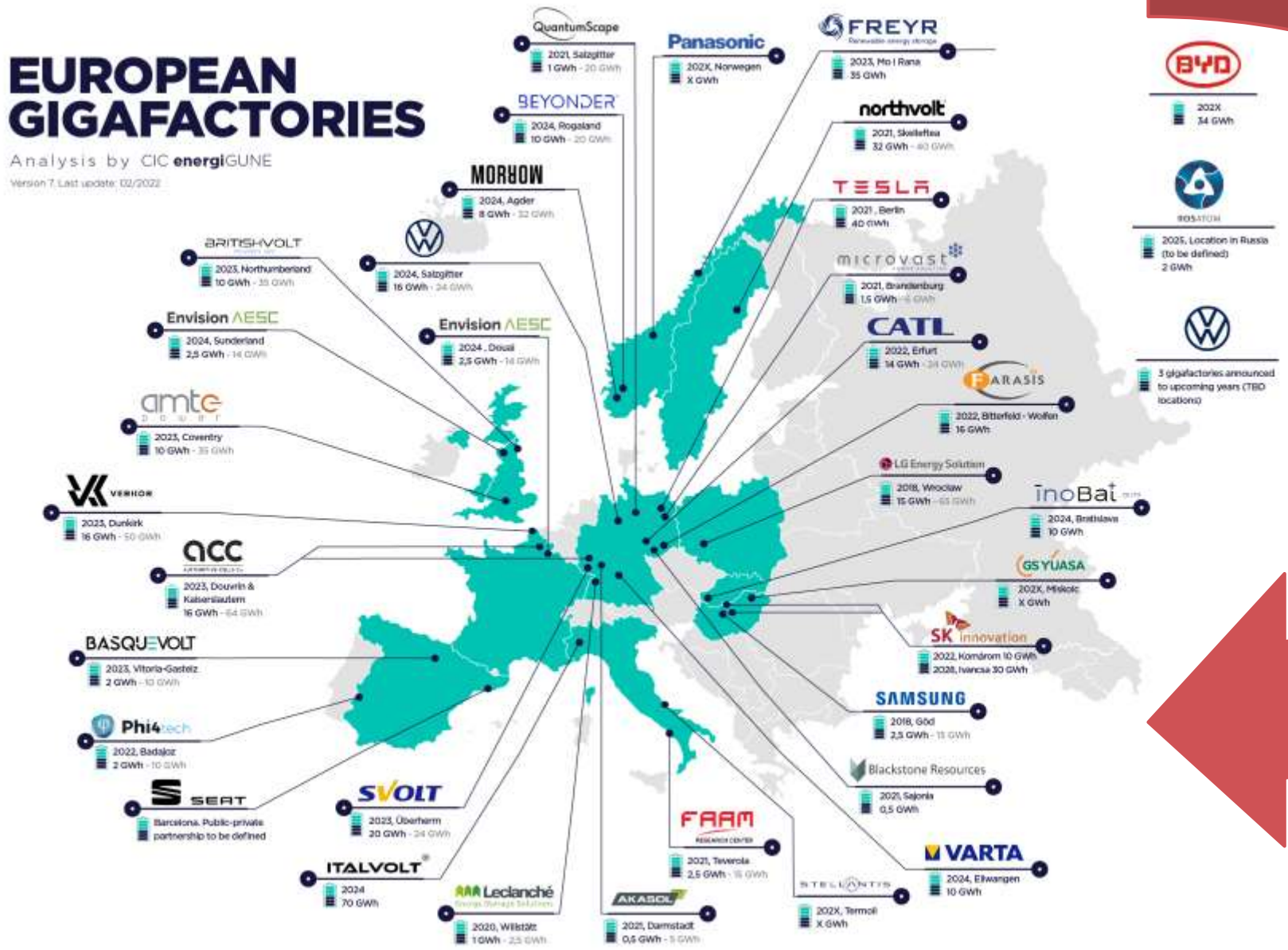
CHALLENGE 1: DOMESTIC SUPPLY IN EUROPE

Increasing Li demand in Europe's battery industry



80% of Europe's Li supply comes from CHINA

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Is it possible to secure sustainable and domestic Li production in Europe?

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Does it work?
Upper Rhine Graben:

2. **Vulcan Energy Resources Ltd.** ("Vulcan", "the Company") has conducted a Definitive Feasibility Study ("DFS") on the Phase One planned commercial development of its Zero Carbon Lithium™ Project ("the Project"), which is a combined geothermal energy (heat and power), lithium extraction and lithium hydroxide refining Project in the Upper Rhine Valley Brine Field ("URVBF"). The URVBF, a hot, deep sub-surface geothermal brine field, is enriched in lithium, and Vulcan's Project is developing dual production of renewable energy and lithium from the same deep brine source. Vulcan aims to produce approximately 24,000 tonnes per annum (tpa) lithium hydroxide monohydrate (LHM) from its Phase One development, as well as over 300 GWh of power and over 250 GWh of renewable heat production.

Source: https://www.investi.com.au/api/announcements/vul/e617fca6-6d4.pdf

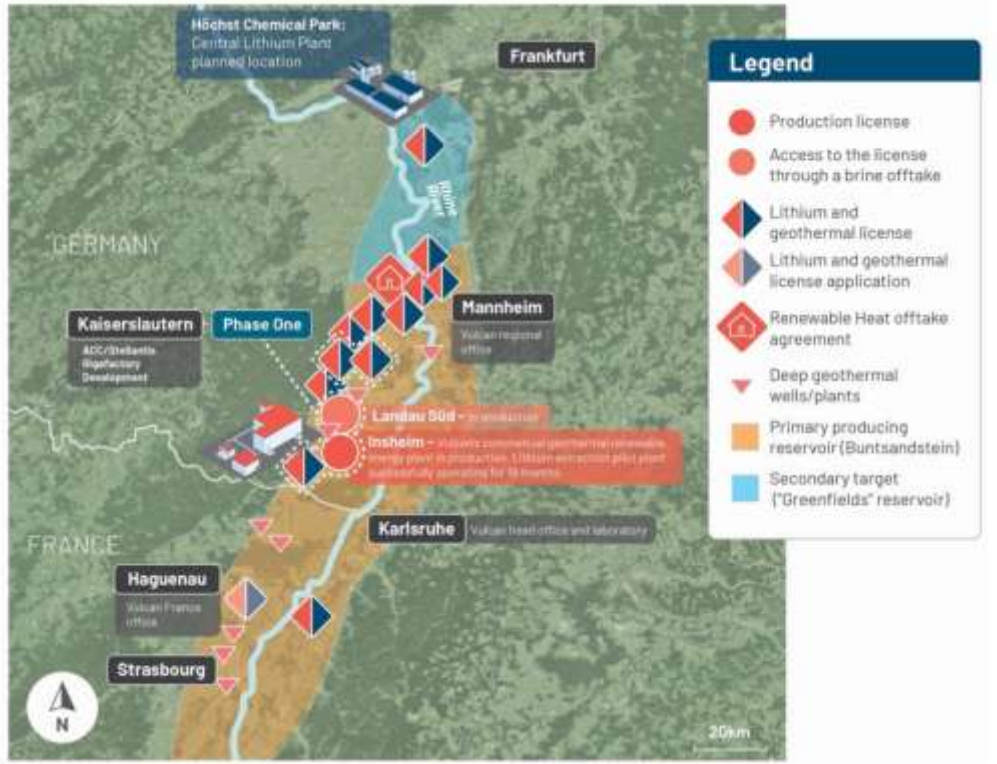

Figure 3: Overview of Vulcan's Zero Carbon Lithium™ Project area, showing Phase One[24].

VULCAN ENERGY

EN | DE | FR Search Drilling Project Regions News FAQs Contact

About us ESG Investor Centre Sustainble Lithium Geothermal Energy

Lithium Extraction Optimisation Plant

Vulcan **LEOP.**

In April 2024, Vulcan has started the production of the first lithium chloride (LiCl) from the Lithium Extraction Optimisation Plant (LEOP). This is the first LiCl domestically produced from a local source with an entirely locally sourced value chain in Europe , for Europe.

Early results have consistently recorded over 90% (up to 95%) lithium extraction efficiency from its A-DLE unit.

Representing a more than €40m investment by Vulcan, LEOP is an optimisation, operational training and product qualification testing facility designed to enable operational readiness for when the Phase One Lionheart commercial facility is completed.

LEOP builds on over three years and more than 10,000 hours of successful in-house A-DLE piloting both in the Vulcan labs and at its pilot plants in Insheim and Landau.

VULCAN ENERGY

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Central Lithium Hydroxide Optimisation Plant

Vulcan **CLEOP.**

At Vulcan's pre-commercial downstream optimisation facility CLEOP we process the lithium chloride solution from our upstream plant LEOP in Landau into lithium hydroxide for the production of electric vehicle batteries. Since the beginning of November the plant is officially opened and producing the first sustainable lithium hydroxide from raw material to end product in Europe, representing a big step for Europe's independence from raw materials and for the transition to zero emission mobility.

CLEOP will be used to optimise operating processes, carry out product quality tests and train Vulcan's operating personnel in preparation for the start of commercial production.

Renewable energy plant

Vulcan **Geothermal Plant.**

In 2022, Vulcan acquired the geothermal power plant in Insheim from Pfalzwerke AG and has been operating it since then. The plant has been in operation since 2012, supplying about 6,500 households in Insheim with renewable power.

Initially planned to produce mostly power, Vulcan's geothermal plant will increase heat production over time.

Vulcan is negotiating a heat offtake agreement with the City of Landau to help them to decarbonise and localise their heat supply and move away from fossil gas.

Source: https://v-er.eu/pilot-plants/

Vulcan Energy
15,816 followers
1w •

NEWS ALERT! Vulcan has announced the start of lithium hydroxide production at its downstream optimisation plant in Industrial Park Höchst Frankfurt, Germany.

The first lithium hydroxide has been produced from the processing of high purity lithium chloride concentrate extracted from brines at its Adsorption-type Direct Lithium Extraction optimisation plant.

Managing Director and CEO, Cris M. said: "First lithium hydroxide production is an important milestone for Vulcan as we demonstrate Europe's first fully domestically produced lithium from the integration of Vulcan's upstream extraction and downstream conversion optimisation plants, and is pivotal for the battery supply chain resilience of both Germany and Europe.

For the full announcement, go to https://bit.ly/3YVX0cz

#europe #decarbonisation #innovation #sustainability #energytransition #lithium #E

(Image credit: Infraserv GmbH & Co. Höchst KG)

eit RawMaterials Connecting makers

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WHY GEOTHERMAL BRINES?

- We need stable, sustainable and unconventional source of Li in Europe
- Occurence in Europe
- Many plants in operation (SLO easier to obtain)
- Combined energy-heat-metal production
- Lower environmental footprint of production
- DLE methods more efficient than 10 years ago
- .....

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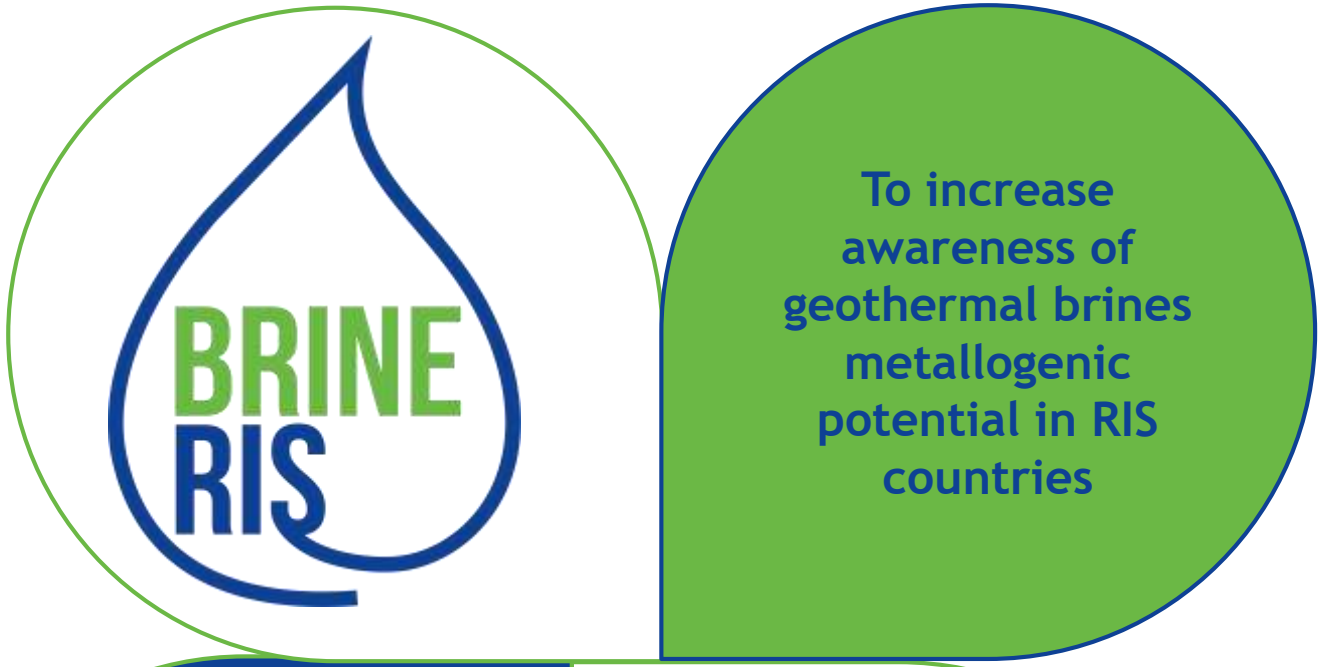
PROJECT GOALS



To increase awareness of geothermal brines metallogenic potential in RIS countries

To attract investors to RIS countries by an interactive platform of geothermal brines projects and investment case for the ERMA.

To build the capacity of RIS countries in low-carbon metals mining technologies related to geothermal brines

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FOUR PROJECT DEVELOPMENT PATHS

MAPPING

First, the participants collected all available information on the occurrence and composition of brines - especially on their lithium content, as there is currently no single place where data (available for entrepreneurs) on geothermal brines are collected.

The project's first step was a sampling campaign organized by the RIS partners. This part is followed by technological testing and modeling at Ghent University and GTK and WUST.

TESTING

CAPACITY BUILDING

Open workshops on the potential of geothermal brine, scientists' study visits, and an autumn school for students in Karlsruhe organized by Vulcan Energy Subsurface Solutions GmbH, GeoLi networking.

The project also created a portal for those interested in investing in brine installations - with access to the information and analysis prepared within **BrineRIS**. ERMA Investment Case has been also submitted.

INVESTING

ERMA

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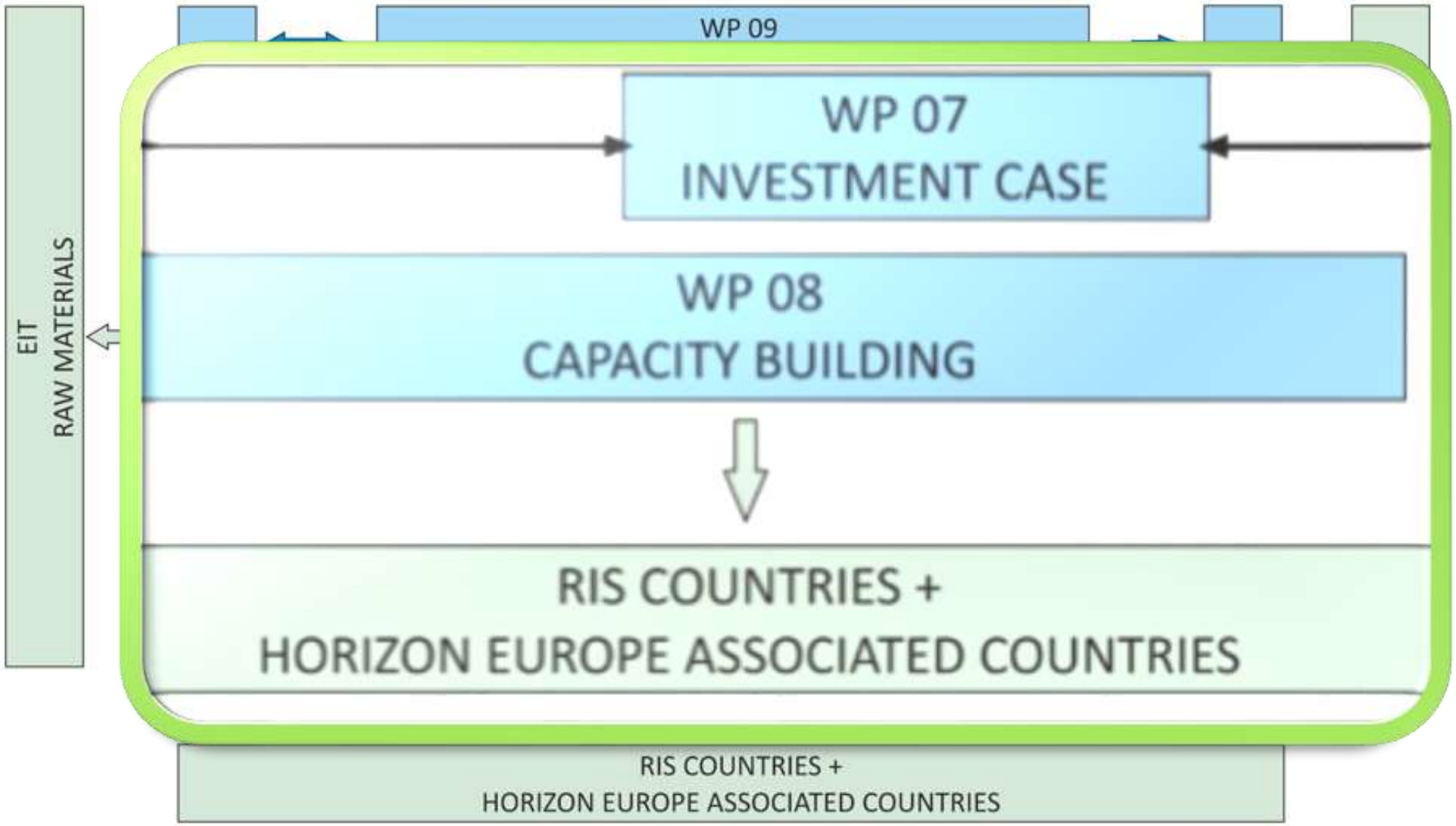
THE PROJECT STRUCTURE



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SAMPLING

TESTING

- Until the end of 2023, 21 brine samples were taken and analysed from 13 different locations:
- 2 samples from the Czech Republic
- 5 from Romania (from three and five neighbouring wells, respectively)
- 2 from Hungary (from two neighbouring wells)
- 5 from Poland
- 4 from Slovakia (two of them are from the same site)
- 17 more samples were taken at 6 locations in Spain,
- sampling is just completed in November 2024.

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August 30-31, 2022 in Espoo, Finland, at GTK- Geological Survey of Finland's headquarters. The two-day hybrid BrineRIS **Professional Training on Geodata Management** was based on the experience and solutions of GTK.

CAPACITY BUILDING

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27-28 September 2022, the **Geothermal Lithium Networking Event** was organized as part of the BrineRIS project in Wrocław. It was the first meeting of its kind in Poland. The conference addressed the use of lithium, its relevance in the world around us, its occurrence in varied natural sources, and recovery technologies.

CAPACITY BUILDING

	IN PERSON	ONLINE
PARTICIPANTS	47	8
COUNTRIES	11	2
FEMALE/MALE	21/26	4/4
GENERAL		
NUMBER OF PRESENTATION		24
NUMBER OF POSTERS		10
NUMBER OF INSTITUTIONS		25

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March 30, 2023, **Professional Development Workshop on Critical Raw Materials in Thermal Waters: Analysis and Assessment**, Miskolc, Hungary

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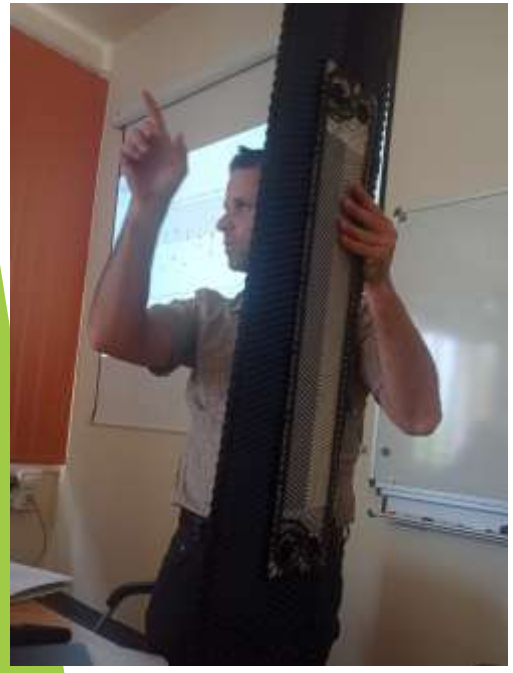
May 10-11, 2023,The professional training on “Renewable Energy Recovery from Geothermal Resources”, Freiberg, Germany

CAPACITY BUILDING



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November 20-24, 2023, Vulcan Energy Subsurface Solutions Autumn School "Renewable energy and lithium production from geothermal brines", Karlsruhe, Germany

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Awarded 11 students out of 72 student applications from 24 nationalities

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SPAIN WORKSHOP

Intensive two-day meeting and practical field trips

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CAPACITY BUILDING

March 21, 2024, Electrochemical methods for metal recovery - WEBINAR -

Webinar: Electrochemical methods for metal recovery

EIT RM Projects BrineRIS

Date: 21st March 2024 from 1 pm to 4 pm (GMT +1)

Place: Online via Teams

GHENT UNIVERSITY

CMET

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Articles

Open Access Article

Assessing the Viability of Integrating Evaporation and Solvent Extraction Systems for Lithium Recovery from Low-Grade Brines

by Katarzyna Ochromowicz [1,*], Monika Zabłocka-Malicka [1], Ida Chojnacka [1] and Magdalena Worsa-Kozak [2]

[1] Division of Analytical Chemistry and Chemical Metallurgy, Faculty of Chemistry, Wroclaw University of Science and Technology, Wybrzeze Wyspianskiego 27, 50-370 Wroclaw, Poland
[2] Department of Mining, Faculty of Geoengineering, Mining and Geology, Wroclaw University of Science and Technology, Na Grobli 15, 50-421 Wroclaw, Poland
* Author to whom correspondence should be addressed.

Processes **2024**, *12*(7), 1453; https://doi.org/10.3390/pr12071453

Submission received: 10 June 2024 / Revised: 3 July 2024 / Accepted: 9 July 2024 / Published: 11 July 2024

Geoscience Data Journal — Open Access — RMetS

DATA ARTICLE Open Access

Analysis and evaluation of the usefulness of open data for research projects—The case of the BrineRIS project

Justyna Górniak-Zimroz, Magdalena Worsa-Kozak, Karolina Szostak

First published: 02 September 2024 | https://doi.org/10.1002/gdj3.269

Dataset:
Creator: Justyna Górniak-Zimroz
Title: Analysis and evaluation of the usefulness of open data for research projects – the case of the BrineRIS project
Publisher: Mendeley Data, V1
Publication year: 2024
doi: https://doi.org/10.17632/dpj5zws6by.1

Multidiszciplináris tudományok, 13. kötet. 4. sz. (2023), pp. 54–70 https://doi.org/10.35925/j.multi.2023.4.6

AN UNUSUAL CASE OF LOW CONCENTRATION MINERAL BRINES IN THE GEOTHERMAL WATERS FROM BEIUȘ BASIN (NORTHWESTERN ROMANIA)

Csilla Balassa
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Norbert Németh
associate professor, Institute of Exploration Geosciences, University of Miskolc
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In review: 1 (Kowalewska I., Worsa-Kozak M., Legal aspects of lithium recovery from geothermal brine - Pyrzyce Geothermal Plant case study)

More in progress..

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Business Breakfasts with EIT Raw Materials 2022 and 2023, Wrocław, Poland

INVES TING

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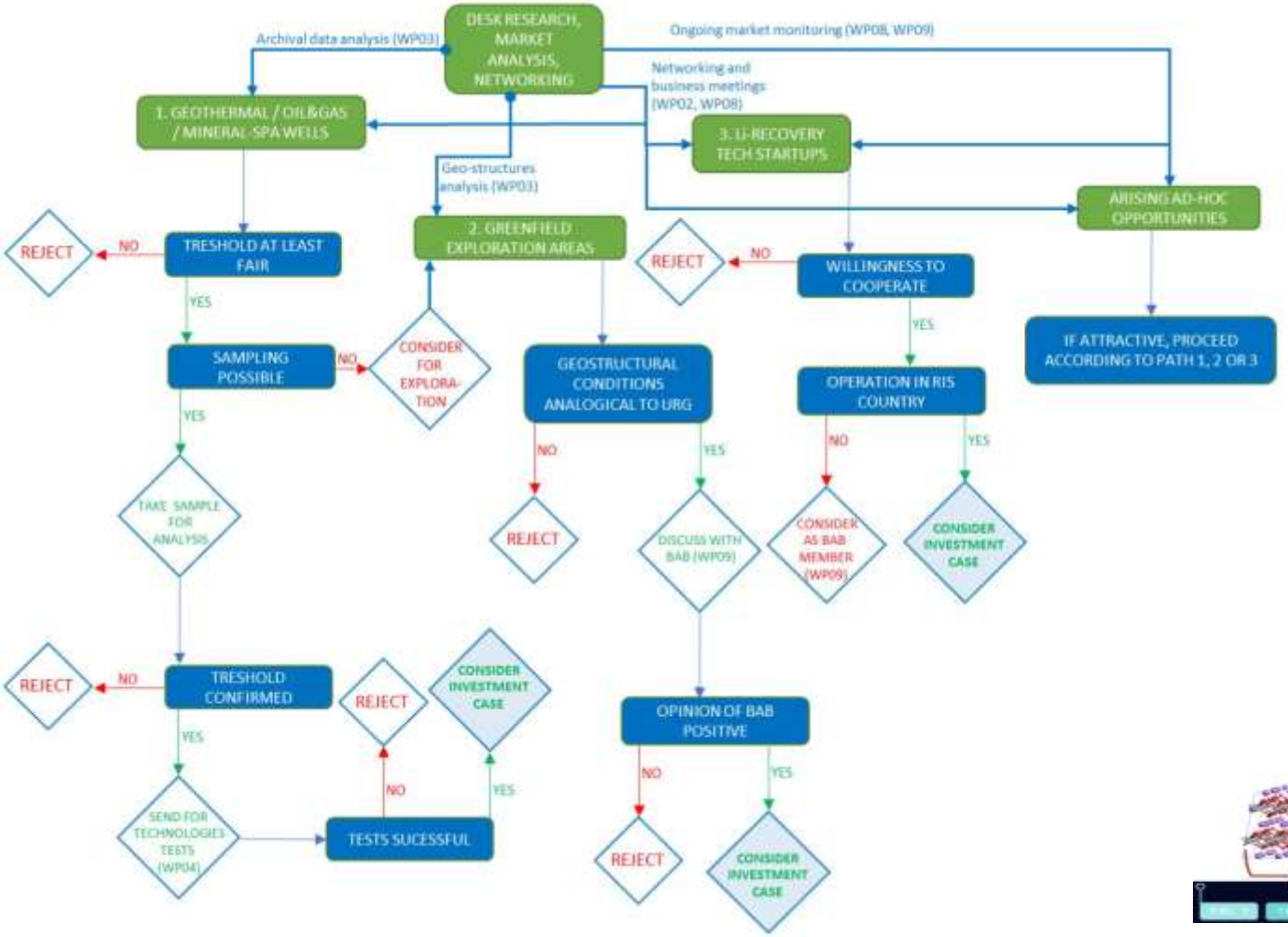
ERMA INVESTMENT PROPOSAL

CompLithium

Technology for comprehensive recovery of lithium and utility water from waste deposit water



Title: CompLithium (Technology for comprehensive recovery of lithium and utility water from waste deposit water)

Funding body: The National Centre for Research and Development, Poland

Project Manager / Principal Researcher: Dr Eng. Ewa Kanpik

Beneficiary: AGH University of Technology, Krakow, Poland

Funding received:1 500 000 PLN

Duration:36 months (starting 1.01.2022)

Purpose and scope of the project

The project aims to develop technologies for the recovery of lithium and utility water from waste deposit brines based on combined sorption and membrane techniques. The proposed solution is a process innovation on a national and global scale.

The project's novelties are:

- Highly porous sorbents produced by 3D printing for lithium recovery with improved selectivity and sorption capacity,
- Nanofiltration membranes modified, among others, crown ethers for the simultaneous production of desalinated water and sorption of residual lithium from brines.

Technology readiness level :

- Before starting the project -> **TRL 2**: the basic principles of operation of individual system components and process limitations are known
- At the end of the project -> **TRL 7**: individual technology components will be integrated and tested in conditions close to real ones

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Collaborate with us! To build the community and sustain the project!

Dr Magdalena Worsa-Kozak
Project Coordinator
magdalena.worsa-kozak@pwr.edu.pl

Wrocław University of Science and Technology

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